Methodological guide to assess the greenhouse gas emissions avoided thanks to the use of technical insulation solutions manufactured by Saint-Gobain

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1 Context and objectives

1.1 Context

In a global framework where the production of fossil fuels reaches a ceiling while the global demand continues to grow and where climate change is accelerating because of the increase of greenhouse gas emissions, the Saint-Gobain group has decided to become a sustainability leader on the construction market by developing and manufacturing high-value construction solutions enabling a reduction of the global use of fossil fuels and thus of the related greenhouse gas emissions, especially through its insulation and glazing businesses.

Following a first calculation[1] and communication done in 2015 during the COP21 in Paris, Saint-Gobain has decided to update and expand the methodology developed at that time with EY to include the calculation of the amount of greenhouse gas avoided thanks to the use of technical insulation solutions while complying with the most recent and recognized international guidelines with regard to the calculation of avoided GHG emissions.

1.2 Objectives

The objective of this work is to enable the communication of GHG emissions avoided to all the group's key stakeholders including investors and regulators.

2 Glossary

As a first step, it is important to remind the meaning of the word "avoided" used in this guide. According to the French Environmental Protection Agency (ADEME), are considered as avoided GHG emissions all emissions which are avoided outside the activity scope of the company, for instance in clients' premises.

The following definition will be useful to facilitate the understanding of this guide:

- **LCA** (Life cycle analysis): Quantitative assessment of various environmental impacts related to the complete life cycle of one product, from the extraction of raw materials used to manufacture the product until its end-of-life

- **Heat loss**: The amount of heat lost per second through a 1m-length of the pipe used to transport a fluid which temperature differs from the exterior temperature

- **Emission factor**: Amount of greenhouse gas (GHG) emitted per activity unit

[1] Scope: Europe only (2014 sales data); based on the same methodology, an update was published in 2017 (2016 sales data) with a rough internal estimate of the avoided emissions on an extended scope: world

3 Calculation rules: technical insulation

3.1 General principles

The calculation is based on the comparison between the amount of heat lost through 1 meter of insulated pipe and the amount of heat lost through 1 meter of uninsulated pipe in technical and industrial applications.

The solutions included into the scope of the study are the insulations solutions used to insulate HVAC pipes (HVAC applications: heating, ventilation, air conditioning) as well as pipes transporting hot and cold fluids in different industries (Industrial applications).

The calculation of the amount of GHG emissions avoided is described and explained separately for these two application domains, for each type of transported fluids (low temperature, mid temperature, high temperature).

3.2 Scope of the study

The study covers the full geographical scope of Saint-Gobain's sales. The first declaration about avoid emission for technical solution has begun in 2019 with sales data for the HVAC solutions and in 2020 data for the industry insulation solutions.

The product covered to define the annual avoid emissions are indicated as below:

HVAC	LR - Air-conditioning
	LR - Hot pipe (55°C)
	LR - Cold pipe (6°C)
	FEF- Air-conditioning
	FEF - Hot tubes (55°C)
	FEF - Cold tubes (6°C)
Industry	High temperature (400°C)
	Medium temperature (200°C)
	Low temperature (84°C)

LR = Laine de Roche (rock wool)
FEF = Flexible Elastomeric Foam

3.3 Characteristics of the insulated pipe

The calculation of avoided GHG emissions requires the definition of the average amount of heat loss per meter of pipe insulated with Saint-Gobain solutions.

These average amounts of heat loss were obtained through a modeling made using the ECOFYS software and were provided directly by the Technical Insulation business unit.

The different values are presented in the table below:

Application	Temperature range	Heat loss insulated pipe (W/m)
HVAC	Air-conditioning	7,24
	Cold fluids (6°C)	2,14
	Hot fluids (55°C)	5,40
Industrial	High temperature (400°C)	142,17
	Mid temperature (200°C)	162,07
	Low temperature (84°C)	59,57

3.4 The reference situation

The reference situation corresponds to an uninsulated pipe for the same applications and range of temperatures than mentioned previously.

These average amounts of heat loss were obtained through a modeling made using the ECOFYS software and were provided directly by the Technical Insulation business unit.

The different values are presented in the table below:

Application	Temperature range	Heat loss uninsulated pipe (W/m)
HVAC	Air-conditioning	41,83
	Cold fluids (6°C)	11,93
	Hot fluids (55°C)	45,06
Industrial	High temperature (400°C)	7 602,76
	Mid temperature (200°C)	3 635,62
	Low temperature (84°C)	899,09

3.5 Methodological rules to calculate the amount of GHG emissions avoided

3.5.1 *General principles*

The methodology is based on the following principles:

- The amount of GHG emissions avoided is obtained by subtracting the amount of emissions generated over the solutions' lifecycle[2] from the amount of emissions avoided thanks to the use of the Saint-Gobain solutions by comparison with the reference situation
- The use of the total length of solutions sold over the year to aggregate the amount of emissions avoided for the full Saint-Gobain technical insulation portfolio

The calculation of the yearly amount of avoided GHG emissions, ∆GHG (considering that ∆GHG > 0 corresponds to a saving) is calculated by aggregating the amount of GHG emissions avoided for each application and each range of temperature, according to the following formula:

$$\boxed{\Delta\mathrm{GHG} = \sum_{\mathrm{application}} \sum_{\mathrm{temperature}} \Delta\mathrm{GHG}_{\mathrm{application\ i,temperature\ j}}}$$

For a given application and range of temperature, the amount of avoided GHG is calculated as follows:

$$\boxed{\Delta\mathrm{GHG}_{a/t} = \left(\mathrm{Savings}_{\mathrm{length}} - \mathrm{Impact}_{\mathrm{length}}\right) * \mathrm{L}_{\mathrm{sales}}}$$

$\mathrm{Savings}_{\mathrm{Length}}$ ($kgCO_{2eq}.m^{-1}$) : Emissions avoided thanks to the use of 1 m of the average Saint-Gobain solution

Impact ($kgCO_{2eq}.m^{-2}$) : Emissions generated during the lifecycle of 1 m of the average Saint-Gobain solution

L (m) : Total length sold during the year for the concerned solution category

[2] i.e. the HVAC or the industrial pipe

The emissions generated during the lifecycle of Saint-Gobain solutions are obtained either from the different LCA produced by Saint-Gobain or from the Environmental Product Declaration (EPD) available. The detail of this calculation is presented in section 3.5.4.

3.5.2 *Calculation of emissions related to avoided heat loss*

The emissions avoided because of a lower amount of heat losses are calculated based on the following formula:

$$\boxed{\mathrm{Savings}_{\mathrm{length}} = \Delta\mathrm{NRJ} * \mathrm{EF}}$$

$\Delta\mathrm{NRJ}$ (kWh.m) : Energy savings from the reduction of heat loss resulting from the use of 1 m of the average Saint-Gobain solution compared to the reference situation

EF (gCO_{2eq}.kWh) : Emission factor of the considered energy (see section 3.5.3)

Energy savings from the reduction of heat losses are calculated as follows:

$$\boxed{\Delta\mathrm{NRJ} = (\mathrm{HL}_{\mathrm{reference}} - \mathrm{HL}_{\mathrm{SG}}) * \mathrm{T}}$$

HL (W. m^{-1}) : Amount of heat lost through 1 meter or pipe

T (hours) : Number of operating hours for the pipe

The different calculation parameters used in the calculation are presented in the table below:

Application	Temperature range	Operating time (hours)	Electricity emission factor (gCO2/kWh)
HVAC	Air-conditioning	4 000	Variable
	Cold fluids (6°C)	8 600	
	Hot fluids (55°C)	3 000	
Industrial	All temperatures	6 600	

Electricity emission factor is calculated by weighting emission factors (scope 2 + 3) by country to sales of industrial insulation products also covering HVAC insulation product (in the absence of sales data by country), using IEA 2030 and 2050 projections.

3.5.3 *Calculation of emission factors*

For HVAC, in the absence of sales data by country, the emission factor considered is the one used for electricity, based on industrial on a sales-weighted average of emission factors by country, considering that most of the HVAC energy consumption relies on electricity.
The emission factor for electricity is calculated on the basis of a weighting between the annual sales of HVAC insulation products per country and the electricity emission factors per country in scopes 2 and 3. The electricity emission factors per country used in the calculation are taken from the IEA database.

For the industry application, various fuels can be used as the primary source of energy to heat (or cool) the fluids that will be transported in the pipes or process installation in the end. The European Insulation Industry Federation[3] provides the following distribution of loss over surfaces per energy source in EU 27 industry (for a total of 16,66 MTOE in 2017), that was considered in the study:

[3] In its study "*The insulation contribution to decarbonise industry*", second edition issued in March 2021

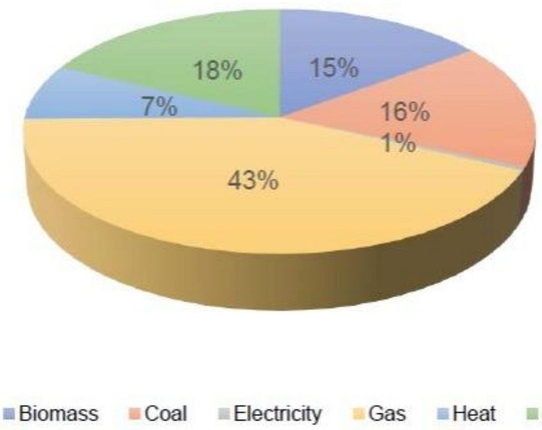

Figure 1: Distribution of energy sources used to heat or cool fluids in industrial applications

An average emission factor was thus calculated by considering the emission factors of each energy source, also provided in the same study of the EIIF and summarized in the table below:

Energy source	**Emission factor** (gCO2eq/kWh)	Loss over surfaces per energy source for 27 EU Industry (%) in 2017
Gas	238	43%
Oil	317	18%
Coal	380	16%
Biomass	197	15%
Heat	40	7%
Electricity (not applicated)	variable	1%

The average EF Mix Industry (gCO_{2eq}.kWh) is calculated as below:

$$\text{EF Mix Industry (gCO2eq. kWh)} = \sum EF_i \times loss\ over\ surfaces\ per\ energy\ source_j$$

3.5.4 *GHG emissions generated during the lifecycle of the average Saint-Gobain solution*

In order to calculate the net avoided GHG emissions, it is necessary to remove from the savings the amount of emissions generated during the different stages of the solution's lifecycle (manufacturing, transportation, disposal, etc.).

These amounts of emissions are calculated following the LCA methodology and most of the time summarized in Environmental Product Declarations (EPD), verified by external third parties.

EPD Name	Publication date
2018_12_10_FDES_ROCFLAM_30MM.	10/12/2018
EPD_Kaiflex EPDMplus_EN	08/06/2020

3.5.5 *Calculation of energy savings – expressed in amount of primary energy*

The savings related to the use of the Saint-Gobain insulation solutions can be expressed in GHG emissions but also in terms of primary energy consumption.

The European union suggests in the directive 2012/27/UE the use of a conversion factor set to 2.5 to transform electrical energy intro primary energy[4]. This factor will be used to calculate the savings in terms of primary energy consumption.

3.6 Calculation of GHG emission avoided and energy savings over the lifespan of the solution

The calculation described above compares the amount of GHG emissions avoided during one year thanks to the use of the Saint-Gobain solution with the amount of GHG emissions generated during the lifecycle of the solution.

The solutions sold and installed during the year N are going to enable energy savings during a large period of time (until the insulation material wears off or is removed from the pipe). The lifespans to be considered in the calculation are summarized in the table below:

Application	Temperature range	Lifespan (years)
HVAC	All temperatures	25
Industrial	High temperature (400°C)	10
	Mid temperature (200°C)	15
	Low temperature (84°C)	20

[4] Appendix IV of the European directive 2012/27/UE of the European parliament of October 25 2012 related to the energy efficiency of buildings Appendix XVII of the updated Energy Efficiency Directive 2023/1791/UE of the European parliament of September 13 2023 doesn't mention any update about the conversion factor.

4 Information and communication

4.1 External communication guidance

All communication related to the amount of avoided GHG emission avoided by one company's solutions must be managed with the highest care in order to avoid any risk of greenwashing. The following principles shall especially be considered:

- Never communicate any amount of avoided GHG emissions without providing at the same time and in the same place the following information
    - The reference situation considered to calculate the savings,
    - The scope of solutions considered,
    - The geographical scope considered,
    - The period of time considered to calculate the amount of emissions avoided;

- Never subtract the amount of avoided GHG emissions from the total amount of GHG emissions generated by the company's activities and operations (scopes 1, 2 and 3), whatever the reason (calculating "net emissions", etc.);

- Especially, the amount of avoided GHG emissions cannot be used to satisfy any "carbon neutrality" objective or to lower the reality of GHG emissions generated by the company;

- Avoid comparing the amount of avoided GHG emissions from one year to another, given the high level of complexity of the calculation and the large number of assumptions taken, which can make comparison difficult or event irrelevant

This methodological guide has been developed in order to illustrate in a robust and transparent way the methodology used to calculate the amount of avoided GHG emissions, in accordance with the principles set in the ISO 14020 and ISO 14021 standards.